TMM001 - COLLEGE ALGEBRA
3-4 Semester Hours/4-6 Quarter Hours

Recommendation: This course should significantly reflect the Mathematical Association of America's Committee on the Undergraduate Program in Mathematics (CUPM) subcommittee, Curriculum Renewal Across the First Two Years (CRAFTY), College Algebra Guidelines.

College Algebra provides students a college level academic experience that emphasizes the use of algebra and functions in problem solving and modeling, where solutions to problems in real-world situations are formulated, validated, and analyzed using mental, paper-and-pencil, algebraic and technology-based techniques as appropriate using a variety of mathematical notation. Students should develop a framework of problem-solving techniques (e.g., read the problem at least twice; define variables; sketch and label a diagram; list what is given; restate the question asked; identify variables and parameters; use analytical, numerical and graphical solution methods as appropriate; determine the plausibility of and interpret solutions).

– Adapted from the MAA/CUPM CRAFTY 2007 College Algebra Guidelines

The prerequisite for College Algebra is a course in Intermediate Algebra (covering topics such as operations and equations with rational expressions, equations of a line, introduction to functions, introduction to systems of linear equations in two or three variables, absolute-value equations and inequalities, rational exponents, operations and equations with radicals, introduction to complex numbers, quadratic equations and various application problems on these topics).

To qualify for TMM001 (College Algebra), a course must cover as a minimum the essential learning outcomes, noted by an asterisk *, which include all the topics under Functions and Equations/Systems. A course in College Algebra may also commonly include some of the listed nonessential learning outcomes. These optional topics should be included only if there is adequate course time to do so beyond giving primary course attention to the essential learning outcomes. At least 70% of the classroom instructional time has to be spent on the essential learning outcomes. The optional learning outcomes are learning experiences that enhance, reinforce, enrich or are further applications of the essential learning outcomes. If review of prerequisite course content is necessary, only a minimal amount of time should be devoted to such review.

The successful College Algebra student should be able to:

1. **Functions ***

   1.1 Represent functions verbally, numerically, graphically and algebraically, including linear, quadratic, polynomial, rational, root/radical/power, exponential, logarithmic and piecewise-defined functions.*

   1.2 Determine whether an algebraic relation or given graph represents a function.*

   1.3 Perform transformations of functions – translations, reflections and stretching and shrinking.*

   1.4 Perform operations with functions – addition, subtraction, multiplication, division and composition.*

   1.5 Analyze the algebraic structure and graph of a function, including those listed in (1.1), to determine intercepts, domain, range, intervals on which the function is increasing, decreasing or constant, the vertex of a quadratic function, asymptotes, whether the function is one-to-one, whether the graph has symmetry (even/odd), etc., and given the graph of a function to determine possible algebraic definitions.*

1.6 Find inverses of functions listed in (1.1) and understand the relationship of the graph of a function to that of its inverse.*

1.7 Use the Remainder and Factor Theorems for polynomial functions.*

1.8 Use functions, including those listed in (1.1), to model a variety of real-world problem-solving applications.*

2. Equations/Systems *

2.1 Understand the difference between an algebraic equation of one, two or more variables and a function, and the relationship among the solutions of an equation in one variable, the zeros of the corresponding function, and the coordinates of the *x*-intercepts of the graph of that function.*

2.2 Determine algebraically and graphically whether the graph of an equation exhibits symmetry.*

2.3 Solve a variety of equations, including polynomial, rational, exponential, and logarithmic, including equations arising in application problems.*

2.4 Solve a system of linear equations graphically and algebraically by substitution and elimination, and solve application problems that involve systems of linear equations.*

2.5 Solve polynomial and rational inequalities graphically and algebraically.*

3. Identify and express the conics in standard rectangular form, graph the conics, and solve applied problems involving conics.

4. Perform operations with matrices – addition, subtraction, scalar multiplication and matrix multiplication, including applications with matrices. Use matrices to solve systems of linear equations, including the Gaussian and Gauss-Jordan elimination methods, using a matrix inverse to solve a matrix equation, and Cramer's Rule.

5. Model real-world data with functions for prediction and analysis, including determining the appropriateness of a model and using hand-held calculator or computer regression capability.

6. Use the Rational Zeros Theorem and the Fundamental Theorem of Algebra to find the zeros of and factor a polynomial into linear factors over the complex numbers.

7. Solve a nonlinear system of equations graphically and algebraically, including nonlinear systems of equations arising in application problems.

8. Solve a linear and nonlinear system of inequalities, including linear and nonlinear systems of inequalities arising from application problems.

9. Express general terms of various sequences (e.g., arithmetic and geometric), write series in summation notation, find the sum of arithmetic and geometric series, and use the Binomial Theorem.